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IS 12620 (1989): Seamless Steel Tubes for Manufacturing High Pressure Gas Cylinders [MTD 19: Steel Tubes, Pipes and Fittings]



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“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

**SEAMLESS STEEL TUBES FOR
MANUFACTURING HIGH PRESSURE
GAS CYLINDERS — SPECIFICATION**

भारतीय मानक

उच्च दाब गैस सिलिंडर निर्माण के लिए सीवनरहित
इस्पात नलिकाएँ — विशिष्ट

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on 20 January 1989, after the draft finalized by the Steel Tubes, Pipes and Fittings Sectional Committee had been approved by the Structural and Metals Division Council.

This standard has been prepared with a view to guide the manufacturers of seamless steel tubes used in the production of seamless steel gas cylinders.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SEAMLESS STEEL TUBES FOR MANUFACTURING HIGH PRESSURE GAS CYLINDERS — SPECIFICATION

1 SCOPE

This specification covers seamless steel tubes (herein after referred to as 'tube'), used in the manufacture of high pressure gas cylinders.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	Title
IS 1757 : 1973	Method for beam impact test (V-notch) on steel (<i>first revision</i>)
IS 1894 : 1972	Methods for testing of steel tubes (<i>first revision</i>)
IS 7285 : 1982	Specification for seamless manganese steel cylinders for permanent and high pressure liquefiable gases (<i>first revision</i>)

3 METHOD OF MANUFACTURE

3.1 The tube shall be seamless, either hot finished or cold finished, processed from billets made by open hearth, electric furnace or basic oxygen process.

3.2 Cold finished tube shall be subjected to normalising after final cold drawing. Hot finished tube may be supplied without normalizing.

4 CHEMICAL COMPOSITION

4.1 The ladle sample analysis of the material shall be as given in Table 1.

4.2 The product analysis of the material shall not deviate from the specified composition by more than the permissible deviation for each element given in Table 2. The product analysis shall be applicable only on mutual agreement between the manufacturer and the purchaser.

5 FREQUENCY OF SAMPLING FOR TEST

5.1 One sample shall be taken for every 300 m of tubes or part thereof for each heat for tensile tests and one sample shall be taken for each heat for every 300 m of tubes or part thereof for bend test.

5.2 Hundred percent sampling for visual and dimensional characteristics shall be carried out.

Table 1 Chemical Composition
(Ladle Sample Analysis)
(Clause 4.1)

Element	Manganese Steel Carbon Manganese (Type 1)	Alloy Steel	
		Chromium Molybdenum Steel (Type 2)	Nickel Chromium Molybdenum Steel (Type 3)
Carbon	0.45 Max	0.25-0.45	0.27-0.35
Manganese	1.30-1.70	0.40-0.90	0.40-0.70
Silicon	0.10-0.35	0.10-0.35	0.10-0.35
Sulphur (Max)	0.040	0.040	0.040
Phosphorus (Max)	0.040	0.040	0.040
Nickel	—	0.50*	2.30-2.80
Chromium	—	0.80-1.20	0.50-0.80
Molybdenum	—	0.15-0.35	0.40-0.70

NOTES

1 Separate chemistry other than that specified may be decided on mutual agreement between the manufacturer and the purchaser.

2 When aluminium or a combination of aluminium and silicon is used for killing the steel the requirements regarding minimum silicon content shall not apply.

3 When steel is aluminium killed, nitrogen content shall be limited to 0.01 percent.

4 When steel is aluminium killed by aluminium alone, nitrogen content shall be limited to 0.007 percent, *Max.*

5 Niobium, vanadium, titanium or boron may be added either singly or in combination for micro-alloying but the total addition shall not exceed 0.2 percent.

*Residual element only.

**Table 2 Permissible Deviation in
Chemical Composition**
(Clause 4.2)

Element	Permissible Deviation on Product Analysis from LSA* Percent
Carbon	± 0.03
Manganese	± 0.04
Silicon	± 0.03
Phosphorus	+ 0.005
Sulphur	+ 0.005
Nickel	± 0.03
Chromium	± 0.04
Molybdenum	± 0.03

*LSA = Ladle sample analysis.

6 TENSILE PROPERTIES AND TESTS

6.1 The test sample shall be either normalized or hardened and tempered before testing.

6.2 The tubes shall conform to the tensile properties requirements specified in Table 3 when tested in accordance with IS 1894 : 1972.

Table 3 Tensile Properties

Element	Manganese Steel		Alloy Steel	
	Carbon Manganese Steel (Type 1) Normalized and Tempered	Hardened and Tempered	Cr Mo Steel (Type 2) Hardened and Tempered	Ni-Cr-Mo Steel (Type 3) Hardened and Tempered
Tensile strength, MPa* (Min) N/mm ²	670	750	780	780
Yield strength, MPa* (Min) N/mm ²	440	550	610	610
Elongation percent (Min)	18	15	15	15

(GL. $5.65 \sqrt{S_0}$)
*1 MPa=1 N/mm²=0.102 0 kgf/mm².

7. IMPACT TEST

7.1 'V' notch (charpy) impact test shall be carried out at 0° Celsius taken from the same tube or test ring as that used to provide the tensile test specimen and shall be taken in longitudinal direction in accordance with IS 1757 : 1973. The notch shall be perpendicular to the face of the tube wall. The test specimens are to be machined all over (on 6 faces). If the wall thickness does not permit a final width of 10 mm, it shall be as near as practicable to the nominal tube thickness. The impact value thus obtained shall not be less than that indicated in Table 4 for each case.

Table 4 Impact Properties

Material	Impact Value (Min) Mean Value MPa	Individual Value (Min) MPa
Mn-steel normalized	49	37
Mn-steel hardened and tempered	69	52
Cr-Mo steel, hardened and tempered	88	67
Ni-Cr-Mo steel, hardened and tempered	88	67

8 BEND TEST

8.1 Bend test shall be conducted on ring samples cut from tubes. The test specimens shall be normalized or hardened and tempered before testing.

The width of the sample shall be 25 mm, *Min*.

8.2 The length of the bend test sample shall not be less than one-third of the circumference of the ring.

8.3 No crack shall occur when the sample is bent inward, 180° over a mandrel of diameter as specified in IS 7285 : 1982.

9 HYDRAULIC TEST

9.1 Hydraulic test shall be carried out at 10 MPa (100 kgf/cm²) and held for a period of 5 seconds and shall not show any leakage.

10 DIMENSIONAL TOLERANCE

10.1 The tolerance on outside diameter, wall thickness, length and varied wall thickness of tubes shall be in accordance with Table 5.

Table 5 Dimensional Tolerances

Tolerance on Outside Dia Including Ovality Percent	Tolerance on Wall Thickness Percent	Tolerance on Deviation in Wall Thickness	Tolerance on Length mm
+ 1	+ 30	20 % or less of the nominal wall thickness	+ 30
- 1	- 0		- 0

NOTE—The tolerance on deviation in wall thickness means the ratio of the difference between the maximum and the minimum wall thicknesses to the nominal wall thickness shall not be applicable to the tube less than 5.6 mm in wall thickness.

10.2 Tolerances other than those specified above may be agreed to between the manufacturer and the purchaser.

11 APPEARANCE

11.1 The tubes shall not deviate by more than 3 mm per metre in straightness and both ends shall be cut square.

11.2 All tubes should be free from harmful defects, such as pits, deep drawlines, heavy roller marks, lamination, cracks etc. Superficial defects on outside diameter may be dressed provided that the remaining wall thickness is within the permissible limits.

The surface defects greater than 5 percent of the shell thickness is not acceptable unless it is processed by taking care of minimum shell thickness, designed as in 5.2.1 of IS 7285 : 1982.

11.3 The tubes shall be given a coating of suitable rust preventing oil.

12 TESTS AND INSPECTION

12.1 Inspection and test shall be, as a rule, carried out at the manufacturer's works.

12.1.1 The results of inspection on appearance, and of dimensions, and ladle analysis, and the tensile and impact properties tests should satisfy the requirements.

12.2 Non-destructive Testing

Each tube shall be tested by ultrasonic method or by leakage flux system. The tubes shall be free from any harmful internal and external surface defects such as seams, cracks, lamination and any other injurious defect.

12.3 When subjected to tensile test, if the test piece breaks beyond 1/4 of the gauge length

from the centre between the gauge marks and result of elongation fails, to satisfy the requirements of the specification, the test shall be discarded and retest may be carried out in the lot from which the first test piece was taken.

13 RE-TEST

13.1 If a tube selected for the test fails in one or more of the tests specified, two further tests of the same kind may be made on two other tubes of the same batch. If all the tests are satisfactory, the tubes shall be deemed to comply with this standard, provided they conform in all other respect, to the requirement of this standard, but if failure occurs again, hundred percent tubes of the lot may be tested.

14 TEST CERTIFICATE

Three copies of the test certificates showing results of the tests shall be provided.

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The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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Amendments Issued Since Publication

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices:

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002

Telephone

{ 331 01 31
331 13 75

Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola
CALCUTTA 700054

36 24 99

Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036

{ 2 18 43
3 16 41

Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113

{ 41 24 42
41 25 19
41 29 16

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
BOMBAY 400093

6 32 92 95

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR.
GUWAHATI. HYDERABAD. JAIPUR. KANPUR. PATNA.
TRIVANDRUM.

AMENDMENT NO. 1 MAY 1997
TO
IS 12620 : 1989 SEAMLESS STEEL TUBES FOR
MANUFACTURING HIGH PRESSURE GAS
CYLINDERS — SPECIFICATION

(Page 1, clause 2) — Substitute the following for the existing clause:

‘2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
1608 : 1995	Mechanical testing of metals — Tensile testing (<i>second revision</i>)
1757 : 1988	Method of Charpy impact test (V-notch) for metallic material (<i>second revision</i>)
7285 : 1988	Seamless steel cylinders for permanent and high pressure liquefiable gases (<i>second revision</i>)’

(Page 2, clause 6.2, line 3) — Substitute ‘IS 1608 : 1995’ for ‘IS 1894 : 1972’.

(Page 2, clause 7.1, line 5) — Substitute ‘IS 1757 : 1988’ for ‘IS 1757 : 1973’.

(Page 2, clause 11.2, line 10) — Substitute ‘IS 7285 : 1988’ for ‘IS 7285 : 1982’.

(Page 3, clause 14) — Insert a new clause 15 at the end:

‘15 MARKING

15.1 Each tube shall be legibly marked with the following:

- a) Indication of the source of manufacture,
- b) Type of the tube and finish, and
- c) The number of this Indian Standard.

15.2 BIS Certification Marking

Amend No. 1 to IS 12620 : 1989

The material may also be marked with Standard Mark.

15.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

(MTD 19)